Image Retrieval using Equalized Histogram Image Bins Moments

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***Abstract*—CBIR operates on a totally different principle from keyword indexing. Primitive features characterizing image content, such as color, texture, and shape are computed for both stored and query images, and used to identify the images most closely matching the query. There have been many approaches to decide and extract the features of images in the database. Towards this goal we propose a technique by which the color content of images is automatically extracted to form a class of meta-data that is easily indexed. The color indexing algorithm uses the back-projection of binary color sets to extract color regions from images. This technique use without histogram of image histogram bins of red, green and blue color. The feature vector is composed of mean, standard deviation and variance of 16 histogram bins of each color space. The new proposed methods are tested on the database of 600 images and the results are in the form of precision and recall.**

***Keywords*- CBIR, Histogram Bins, Standard deviation, Variance, Precision, Recall.**

I. Introduction

From ages images have been the mode of communication for human being. Today we are able to generate, store, transmit and share enormous amount of data because of the exhaustive growth of Information and Communication Technology. After a decade of intensive research. CBIR technology is now beginning to move out of the laboratory and into the marketplace, in the form of commercial products like QBIC and Virage .However, the technology still lacks maturity, and is not yet being used on a significant scale. In the absence of hard evidence on the effectiveness of CBIR techniques in practice, opinion is still sharply divided about their usefulness in handling real-life queries in large and diverse image collections. The goal of an image retrieval system is to retrieve a set of images from a collection of images such that this set meets the user's requirements. The user's requirements can be specified in terms of similarity to some other image or a sketch, or in terms of keywords. An image retrieval system provides the user with a way to access, browse and retrieve efficiently and possibly in real time, form these databases [7].Well-developed and popular international standards, on image coding have also long been available and widely used in many applications. The challenge to image indexing is studied in the context of image database, which has also been actively researched by researchers from a wide range of disciplines including those from computer vision, image processing, and traditional database areas for over a decade. Image retrieval systems can be divided into two main types: Text Based Image Retrieval and Content Based Image Retrieval. In the early years Text Based Image Retrieval was popular, but nowadays Content Based Image Retrieval has been a topic of intensive research [10].

A. Text Based Image Retrieval

Text Based Image Retrieval is the traditional image retrieval system. In traditional retrieval systems features are added by adding text strings describing the content of an image. In contrast to text, images just consist of pure pixel data with no inherent meaning. Commercial image catalogues therefore use manual annotation and rely on text retrieval techniques for searching particular images. However, such an annotation has following main drawbacks:

The first problem with manual annotation is that it is very time consuming. While it may be worthwhile for commercial image collections, it is prohibitive for indexing of images within the World Wide Web. One could not even keep up with the growth of available image data.

The second major drawback is that the user of a Text Based Image Retrieval must describe an image using nearly the same keywords that were used by the annotator in order to retrieve that image. Due to all these drawbacks, Content Based Image Retrieval is introduced [16].

B. Content Based Image Retrieval

The typical CBIR system performs two major tasks. The first one is feature extraction (FE), where a set of features, called image signature or feature vector, is generated to accurately represent the content of each image in the database. A feature vector is much smaller in size than the original image, typically of the order of hundreds of elements (rather than millions). The second task is similarity measurement (SM), where a distance between the query image and each image in the database using their signatures is computed so that the top "closest" images can be retrieved [3], [13], [14], [15].

C. Similarity Measures

Finding good similarity measures between images based on some feature set is a challenging task. On the one hand, the ultimate goal is to define similarity functions that match with human perception, but how humans judge the

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similarity between images is a topic of ongoing research. The Direct Euclidian Distance between an image P and query image Q can be given as the equation below.

$$ED = \sum_{i=1}^{n} \sqrt{(Vpi - Vqi)^2} \quad (1)$$

where, Vpi and Vqi be the feature vectors of image P and Query image Q respectively with size ‘n’.

This paper organized in the following sections: Section II, review histogram based image retrieval. Section III, proposed algorithm feature extraction. Experimental results are given in Section V. Finally Section VI is devoted to concluding the remarks.

II. IMAGE INDEXING AND RETRIEVAL BASED ON HISTOGRAM

Color is one of the most reliable visual features that are also easier to implement in image retrieval systems. Color is independent of image size and orientation, because, it is robust to background complication. Color histogram is the most common technique for extracting the color features of colored images [1,13]. In image retrieval area Color histograms are widely used for CBIR systems. It is one of the most common methods for predicting the characteristics of the image. However, color histogram hold two major shortcomings. Moreover, similar images of same point of view carrying different lighting conditions create dissimilar histograms. The proposed method strives for a light weight computation with effective feature extraction. Digital images undergo the following process in order to produce an effective feature vector describing an eminent feature set targeted to avoid the lack of robustness of a common histogram. The histogram equalized image is split into 16 fixed bins in order to extract more distinct information from it.

The frequencies of 256 values of each color planes are split into sixteen (16) bins carrying 16 values each (0~15, 16~31, 32~ 47, 48~63, and so forth). This is done by turning off the color values of image which do not lie between the particular bins. This gives 48 images carrying objects which lie in the specific frequency ranges, and all different from each other. This provides a better illustration of image segments and simplifies the computation of features for the distinct portion of image.

III. OUR PROPOSED METHOD FOR CBIR.

Histogram equalization is a method in image processing of contrast adjustment using the image's histogram. The method can lead to better views of structure in images, and to better detail in the case that are over or under-exposed. [6]. Proposed algorithm steps are given below:

1. Here we have use RGB color space. So given image split into R, G & B components.
2. Plot histogram of each plane which is having 256 bin values for red, green and blue plane.
3. Plot equalized histogram of obtained histogram in above step 2 for each red, green and blue plane.
4. Compute equalized histogram image for each color space.
5. The histogram equalized image is split into 16 fixed bins in order to extract more distinct information from it. The frequencies of 256 values of red, green and blue color space.
6. For color space red the histogram equalized image and random any four bins are shown in Fig.1.

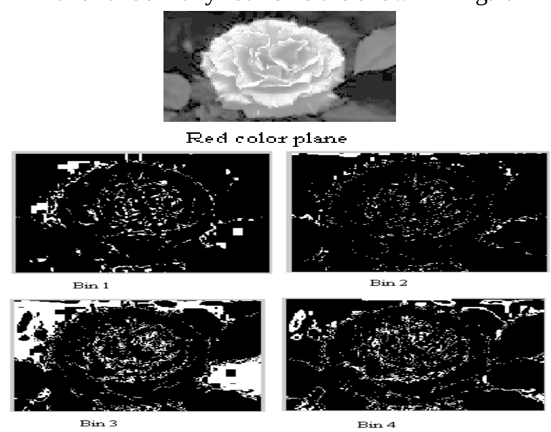

Figure 1.Red color histogram equalized image and its 1, 2, 3 and 4 bins .

7. Then compute sum of the pixels of each bins for each color plane. So it gives us 16 values for each histogram equalized color plane.
8. Then compute the standard deviation and variance of each bin for each color space using following equations 2 and 4 respectively.

$$\text{Std\_Deviation} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X})^2} \quad (2)$$

Where $\bar{X}$ is the mean that is given by

$$\bar{X} = \frac{1}{n}\sum_{i=1}^{n} X_i \quad (3)$$

X_i : is a pixel value.

n : total no. of pixels in a give image.

and variance is given as

$$\text{Variance} = \frac{1}{n}\sum_{i=1}^{n}(X_i - \bar{X}) \quad (4)$$

9. Thus feature vector is composed of 144 coefficients computed for each image in data base image.
10. Euclidean Distance given in equation 1. computed between each database image & query image on feature vector to find set of images falling in the class of query image.

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IV. IMPLEMENTATION

The implementation of the CBIR technique is done in MATLAB 7.0 using a computer with Intel Core 2 Duo Processor T8100 (2.1GHz) and 2 GB RAM.

A. The Image Database

The CBIR technique are tested on the image database [25] of 600 variable size images spread across 6 categories of bike, animals, natural scenery, flowers etc.,.

B. Simulation and results

To assess the retrieval effectiveness, we have used the two parameters for image retrieval using histogram bins. The standard definitions of these two measures are given by following equations.

$$\text{Precision}=\frac{\text{Number\_of\_relevant\_images\_retrived}}{\text{Total\_number\_of\_images\_retrived}} \qquad (5)$$

$$\text{Recall}=\frac{\text{Number\_of\_relevant\_images\_retrived}}{\text{Total\_number\_of\_relevant\_images\_in\_database}} \qquad (6)$$

The average precision for images belonging to the qth category (Aq*)* has been computed by:

$$\overline{P}_q=\sum_{k\in Aq} P(I_K)/\left|(A_q)\right|, q=1,2,....10 \qquad (7)$$

Finally, the average precision is given by:

$$\overline{P}=\sum_{q=1}^{10}\overline{P_q}/10 \qquad (8)$$

The average recall is also computed in the same manner. Average precision and recall for proposed method is shown in table I.As illustrated in Fig.2 average precision and recall for bus, dinosaurs, flowers and horses are more than other category of images.

Table I . Precision And Recall For Proposed Method

Sr.No.	Category	Precision %	Recall%
1	Bike	89.65	78
2	Buss	69.85	95
3	Dinosaurs	73.2	45
5	Elephants	45.09	35
6	Horses	71.42	50
7	Flowers	98.11	52
	Total	74.55	59.16

V. CONCLUSION

Experiments prove that region specific histogram properties can be very useful, because, they add robustness to the histograms that, in turn, add uniqueness of characterization among a set of similar images. Hence, it can be stated that two dissimilar images can be distinguished by considering the local feature set, and similar images can be apparently retrieved holding a low computational cost and improved characterization of image features.

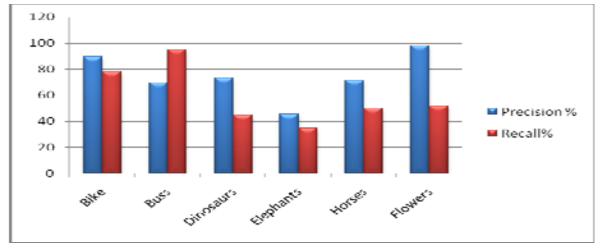

Figure 2. Precision and Recall verses category plot

This approach use feature vector of equalized histogram bins moments. Equalized histogram bins feature vector developed for grayscale image coding. In this new method we use Equalized Histogram RGB color space to get new Content Based Image Retrieval technique as Equalized Histogram Image Bins to compute feature vector as a combination standard deviation ,variance and of sum of the value of each bin of each color space.

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